Effect of Humic acid, bio and chemical fertilizer on growth and yield of onion cultivar, Giza 20 under Sohag conditions

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Abstract

The present study was carried out at El- kawamel Experimental Farm, Faculty of Agriculture, Sohag University, Sohag, Egypt during winter 2011/ 2012 and 2012/2013 seasons to investigate the effect of humic acid, bio and chemical fertilizer on growth and yield of onion cultivar Giza 20. Humic acid, Rhizobactrein (*Azotobacter chrocoocum +Azospirelum sp.* 105 -107/ml liter), phosphorin (*Bacillus megatherium* 105 -107\ml liter) and potasiumag (*Bacillus circulance* 105 -107/ml liter) were used solely or combined with each of other and with 1/4, 1/2 and 3/4 the recommended dose of NPK chemical fertilizers. The obtained results indicated that the recommended dose of NPK gave the highest values for characters i.e., plant height (cm) ,number of leaves/ plant, total bulbs yield after curing (ton/fed.) and local marketable bulbs yield (ton/fed.). Also, the treatment onion bulbs with the recommended dose lead to increase for character i.e., weight of double bulbs (ton/fed), number of bolting bulbs (ton/fed) and weight of culls (ton/fed.). The treatment (Humic + org + 3/4 NPK) gave the best results for characters total bulbs yield after curing (ton/fed.) and exportable bulbs yield(ton/fed.). While , treat onion bulbs with (Humic + 3/4 NPK) gave the best results for bulbing ratio but the lowest values for weight of double bulbs (ton/fed) , number of bolting bulbs /fed and weight of culls (ton/fed.) were recorded by treat the bulbs by (Rhizobactrein + phosphorin + potasiumag).

Key words:

Onion, bio-fertilizer, organic fertilizer, yield and quality

Introduction

Onion (*Allium cepa* L.) is a one of Alliaceae family and is of great benefit to man due to its dietic and medicinal values. Onion is one of the most important vegetable crops in Egypt where it is an important condiment in the preparation of spicy dishes. It has been reported that onion extract can be a potent cardiovascular and anticancer agent with hypocholesterolemic, thrombolitic and antioxidant effects (Block, 1985). Egypt produces about 21.8% of Africa production, which produces about 11.2% of world production. (FAOSTAT, 2013). The total cultivated area of onion crop in 2013 reached about 117.000 feddan of which about 87.000 feddan old lands represents about 73.94% of the total cultivated onion crop space, and about 30.000 feddan of new lands represent about 26.06% of the total cultivated crop area. Intensive nitrogen fertilization causes increase yields of vegetable crops but often may have a negative effect on their quality and on the environment condition. Many researches showed that the importance of effect of NPK on vegetative and yield components in onion plants which lead to rapid growth, high yield and good bulb maturity such as i.e., Dragland (1984), Pankove (1984) , Smittle (1984), Henrikesen (1987), El-Maziny and Hassan (1990), Patel and Patel (1993) and El Shaikh (1995).

Currently the new attitude which was raised in relation to agriculture as sustainable agriculture, organic and biological is based on utilization of such resources. Bio-fertilizers do not include just organic fertilizers derived from animal, plant wastes and etc. but it contains the products of the activity of microorganisms in relation to availability of nitrogen fixation and phosphorus and other soil nutrients are also included. Bio-fertilizers are addressed as the most natural and most desirable solution for keeping the soil system alive. Giving the organic matters to the soil, especially in arid and semi-arid soils, are the biggest advantages of such fertilizers. In addition, providing nutrients for proper plant nutrition and balance in the supply of these elements, helping the biodiversity, increas-

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-ing vital activity, improving environmental quality and preventing environment pollution and in general protection of national land and water resources, as well as nonrenewable energy resources are the main reasons for the necessity of the use of bio-fertilizers. There are many researchers studied the effect of bio and organic fertilizer on onion plants characteristics such as i.e., Hafez (2003), Aswani et al., (2005), Yadav, et al., (2005) ,Navale et al., (2008), Mahanthesh et al., (2008) ,Sangeethaand Singaram (2007), Devi et al., (2008), Dubey and Singh (2008),Mahanthesh et al., (2008), El Shaikh et al.(2009) ,Radwan and Hussein (2009) ,Bagali et al. (2012) and Ahmed et al. (2013).

Materials and Methods

This study was carried out at El- kawamel Experimental Farm, Faculty of Agriculture, Sohag University, Sohag, Egypt during winter 2011/ 2012 and 2012/2013 seasons. Onion cultivar (Giza 20) was used in this investigation to study the effect of organic and bio fertilization on yield and quality. Three soil sample were randomly taken form soil before transplanting , air dried, crushed, sieved and used to determine, the following physical and chemical analysis of the experimental soil are presented in Table (1).

Table (1): Some physiochemical characteristics of El- kawamel experimental farm (New reclaimed soil).

Character	value	Character	Value
Depth (cm)	0-30	Sand %	65.92
EC (1-5) dsm-1	0.6	Texture grade	Sandy Loam
pH	7.9	Total N %	40
CaCO3%	3.0	P (ppm)	14
Clay %	12.08	K (ppm)	240
Silt %	22	Organic matter %	0.59

The types for both organic, bio and chemical fertilization in this study as follows:

A) - Humic acid: (Humiky 85%) contain: humic acid 85% + potassium humate 8% + fulfulic acid 3% was applied in two equal doses (the recommended dose 5 kg/fed.) The first dose was before transplanting and the second was at 30 days after transplanting.

B)-biofertilzers: Rhizobactrein (*Azotobacter chrocoocum* +Azospirelum sp. 105 -107/ml liter), phosphorin (*Bacillus megatherium* 105 -107\ml liter) and potasiumag (*Bacillus circulance* 105 -107/ml liter).

Onion transplants were soaked for half an hour in the inoculation suspension. Gum Arabic solution 4% was used as an adhesive material as recommended. In addition, reinoculation was done for the second time after 60 days from transplanting through soil injection. Then, the experimental units irrigated immediately.

C) - **Chemical fertilizers (NPK)** the recommended dose of NPK were 120 kg N/ fed., 60 kg P2O5 / fed. and 100 kg K/fed., respectively. Nitrogen chemical fertilizer was applied in the form of urea (46.5 % N) in three equal doses at 25, 50 and 75 days after transplanting. Whereas, phosphorus chemical fertilizer was applied as one does just before transplanting in the form of calcium superphosphate (15.5% P2O5). Potassium fertilizer was applied in two equal doses in the form potassium sulfate (50% K2O) at 25 and 75 days after transplanting and agricultural practices other than the aforementioned treatments were conducted as usual in both seasons.

Onion transplants were planted in 1st of November in 2011/2012 and 2012/2013 winter seasons at 7.5 cm apart. Each experimental plot was 3 x 3.5 = 10.5 m2 and contained 5 ridges 60 cm apart. Each plot received equal number of onion transplants as well as ridges. The experimental plots were randomly assigned in a randomized complete blocks design with three replicates; every replicate consisted of fourteen plots as follows for each cultivar:

1. Untreated (control).

2. Recommended doses of NPK (120 kg N/fed. + 60 kg P2O5/fed. + 100 kg K2O/fed.) (R.D)

3. Rhizobactrein + phosphorin + potasiumag (RHIZ.+ PHOS. + POTAS.)

4. Humic acid

5. (Rhizobactrein + phosphorin + potasiumag) + HUMIC ACID.

6. (RHIZ.+ PHOS. + POTAS.)+ 90 kg N/fed. +45 kg P2O5/fed. + 75 kg K2O/fed.

7. (RHIZ.+ PHOS. + POTAS.) + 60 kg N/fed. + 30 kg P2O5/fed. + 50 kg K2O/fed.

8. (RHIZ.+ PHOS. + POTAS.)+30 kg N/fed. + 15 kg P2O5/fed. + 25 kg K2O/fed.

9. Humic acid + 90 kg N/fed. + 45 kg P2O5/fed. + 75 kg K2O/fed.

10. Humic acid + 60 kg N/fed. + 30 kg P2O5/fed. + 50 kg K2O/fed.

11. Humic acid + 30 kg N/fed. + 15 kg P2O5/fed. + 25 kg K2O/fed.

12. (RHIZ. + PHOS. + POTAS.) + HUMIC ACID + 90 kg N/fed. + 45 kg P2O5/fed. + 75 kg K2O/fed.

13. (RHIZ.+ PHOS. + POTAS.) + HUMIC ACID + 60 kg N/fed. + 30 kg P2O5/fed. + 50 kg K2O/fed.

14. (RHIZ.+ PHOS. + POTAS.) + HUMIC ACID + 30 kg N/fed. + 15 kg P2O5/fed. + 25 kg K2O/fed.

Studied characters

Vegetative characteristics.

At 120 days after transplanting, a random sample of 10 plants was taken from each plot to measure the following characteristics:

1. Plant height (cm); 2.Number of leaves/ plant; 3. Bulbing ratio calculated as (neck diameter / bulb diameter).

Yield characteristics.

1. Weight of total bulbs yield after curing (ton/fed.).
2. Weight of local marketable bulbs yield (Total bulbs yield after curing except Exportable bulbs yield ton/fed.).
3. Weight of exportable bulbs yield (bulbs with diameter from 3 to 6 cm (ton/fed.).
4. Weight of Double bulbs (ton/fed). 8. Number of bolting bulbs /fed.
5. Weight of Culls (ton/fed.)

I. 3**Storability characters.**

The following characters were recorded every30 day intervals on the stored bulbs.

1. Decay bulbs % calculated as:

$$\text{Decay bulbs \%} = \frac{\text{No. of decay bulbs}}{\text{Total No. of bulbs at the beginning of storage}} \text{X } 100$$

2. Weight loss % calculated as:

$$\text{Weight loss \%} = \frac{\text{weight of bulbs at the end of storage}}{\text{Weight of bulbs bulbs at the beginning of storage}} \text{X } 100$$

Statistical analysis:

All data were statistically analyzed according to technique of analysis of variance (ANOVA) as randomized complete block design by Gomez and Gomez (1984).

Results and Discussions

Plant height (cm)

Data dealing with the effect of bio-fertilization , NPK chemical fertilizer and their interactions on plant height (cm) in 2011-2012 and 2012-2013 seasons are presented in Table (2) clearly show that there were significant differences among the all fertilizer treatments in both studied seasons. The tallest onion plants were determined when applied the NPK dose to onion plants in the first and second seasons while there was no significant difference between NPK dose and (Bio + org + 3/4 NPK) treatment in the second season only. In the other hand, the untreated onion plant recorded the shortest onion plants in both studied seasons. These findings are in harmony with those reported by Dragland (1984), El-Maziny and Hassan (1990), El Shaikh (1995), Almadini et al., (2000) , Hafez (2003), Gamal and Hemida (2004) and El-Morsy and Shokr (2005) they found that supply of NPK to the onion plants gave rapid growth.

Table(2): Effect of Humic acid , biofertilizers and NPK chemical fertilizer of onion plant cultivar Giza 20 on plant height (cm), Bulbing ratio and number of leaves/plant in 2011-2012 and 2012-2013 seasons under Sohag conditions.

Characteristics Treatments	Plant height (cm)		Bulbing ratio		Number of leaves/ plant	
	2011/2012	2012/2013	2011/2012	2012/2013	2011/2012	2012/2013
Untreated	52.43 G	50.93 F	0.4800 B	0.4300 B	7.637 D	7.667 C
NPK(Recommended dose)	75.07 A	74.75 A	0.430 DE	0.3733 D	9.233 A	9.370 A
Rhizobactrein + phos-phorin + potasiumag (Bio)	56.17 F	54.80 E	0.4267 DE	0.4300 B	8.830 AB	8.407 B
Humic acid (org)	58.33 EF	55.40 E	0.5000 A	0.4633 A	8.883 AB	8.667 B
((Bio) + (org))	56.73 F	53.54 E	0.4433 CD	0.4633 A	8.113 BCD	8.777 B
(Bio + 3/4 NPK)	65.58 BC	67.44 C	0.4000 F	0.3767 D	7.977 CD	8.563 B
(Bio + 1/2 NPK)	63.91 BC	62.73 D	0.4500 C	0.3800 D	8.633 ABC	8.557 B
(Bio + 1/4 NPK)	60.71 DE	65.33 C	0.4700 B	0.4500 A	8.290 BCD	8.447 B
(org + 3/4 NPK)	66.52 B	71.98 B	0.4167 EF	0.3867 D	8.883 AB	8.357 B
(org + 1/2 NPK)	58.35 EF	61.28 D	0.4367 CD	0.4500 A	8.127 BCD	8.670 B
(org + 1/4 NPK)	58.50 EF	53.00 EF	0.4733 B	0.4100 C	8.340 BCD	8.433 B
(Bio + org + 3/4 NPK)	63.17 CD	73.33 AB	0.440 CD	0.4100 C	8.623 ABC	8.707 B
(Bio + org +1/2 NPK)	59.35 EF	65.68 C	0.4433 CD	0.4233 BC	8.183 BCD	8.783 B
(Bio + org +1/4 NPK)	56.44 F	62.00 D	0.440 CD	0.4200 BC	8.320 BCD	8.483 B

Values followed by the same letter or letters are not significantly different at 5% level.

Bulbing ratio

Data presented in Table (3) obviously reveal that the best results of bulbing ratio were determined when onion plants received treatment (Bio + 3/4 NPK) in both studied seasons. The results in Table 2 represented that most treated of onion plant by using both humic and bio fertelizer lead to improved bulbing ratio in onion plants. These results take the same general trends which were found by EL-Morsy and Shokr (2005).

Table(3): Effect of Humic acid , biofertilizers and NPK chemical fertilizer of onion plant cultivar Giza 20 on total bulbs yield (ton\fed.), local marketable bulbs yield (ton/fed.) and exportable bulbs yield(ton/fed.) in 2011-2012 and 2012-2013 seasons under Sohag conditions.

Characteristics Treatments	Total bulbs yield after curing (ton/fed.)		Local marketable bulbs yield (ton/fed.)		Exportable bulbs yield(ton/fed.)	
	2011/2012	2012/2013	2011/2012	2012/2013	2011/2012	2012/2013
Untreated	9.68 F	9.237 G	1.547 G	1.51 D	8.13 EF	7.720 I
NPK(Recommended dose)	13.34 A	13.15 AB	4.007 A	3.55 A	9.33 BC	9.60 CD
Rhizobactrein + phosphorin + potasiumag (Bio)	10.43 E	10.40 F	1.925 FG	2.09 BCD	8.46 DE	8.307 GH
Humic acid (org)	11.65 C	11.38 E	2.645 CDEF	2.777 B	9.0 BCD	8.60 FG
((Bio) + (org))	12.35 B	11.44 E	2.81 BCDE	2.16 BCD	9.540 B	9.26 DE
(Bio + 3/4 NPK)	13.03 A	12.71 BC	2.10 EFG	2.31 BC	10.93 A	10.40 B
(Bio + 1/2 NPK)	12.27 B	12.27 CD	1.89 FG	2.43 BC	10.37 A	9.82 C
(Bio + 1/4 NPK)	11.73 C	11.35 E	2.22 DEFG	1.77 CD	9.507 B	9.57 CD
(org + 3/4 NPK)	12.89 A	13.04 AB	3.579 AB	2.609 B	9.37 BC	10.43 B
(org + 1/2 NPK)	11.38 CD	11.55 E	2.21DEFG	1.78 CD	9.16 BC	9.78 CD
(org + 1/4 NPK)	11.02 D	10.75 F	3.080 BC	2.67 B	7.80 F	8.08 HI
(Bio + org + 3/4 NPK)	13.39 A	13.33 A	2.99 BCD	2.35 BC	10.47 A	10.97 A
(Bio + org +1/2 NPK)	11.64 C	11.82 DE	2.33CDEFG	1.75 CD	9.30 BC	10.07 BC
(Bio + org +1/4 NPK)	10.89 DE	10.53 F	2.14 EFG	1.51 D	8.74 CD	9.04 EF

Values followed by the same letter or letters are not significantly different at 5% level.

Number of leaves/plant

Data concerning the effect of biofertilization and NPK chemical fertilization and their interactions on number of leaves/ plant during 2011-2012 and 2012-2013 seasons are shown in Table (2) clearly reveal that inoculating onion transplants with humic acid, bio fertilizers with NPK were improved number of leaves/plant as compared to untreated ones in both seasons. The highest values of this trait were recorded when plants fertilized with NPK treatment in both seasons. Moreover, best results were noticed in the second season when used all combinations between humic and bio fertilizer with NPK fertilizer. These findings are in line with those reported by El-Maziny and Hassan (1990), El-Oksh et al., (1993), Zahran and Abdoh (1998) , Almadini et al., (2000) and El Shaikh (2005) they found that combined application of recommended dose of inorganic fertilizers humic acid and bio-fertilizer increased plant growth and number of leaves.

Total bulbs yield after curing (ton/fed.)

Data illustrated in Table (3) show that inoculation of onion transplants with humic acid, bio fertilizers with NPK significantly influenced this character as compared to untreated ones in the two experimental seasons. The results indicated that there were significant differences among the all fertilizer treatments in both seasons. The highest total bulbs yield were recorded when onion plants apply with NPK, (Bio + org + 3/4 NPK) and (org + 3/4 NPK) treatments respectively in both studied seasons. While, untreated plants gave the lowest total bulbs yields in both seasons. These increases in total bulbs yield by mineral fertilizers over than organic fertilizers might be attributed to the role of nitrogen on chlorophyll, enzymes and protein synthesizes and the role of phosphorous on root growth and development as well as the role of potassium on promotion of enzymes activity and enhancing the translocation of assimilates. These results are in agreement with those found by Al-Moshileh (2001) Muhammad *et al.* (2012), El-Shaikh (2005), El-Desoki *et al*., (2006) and Mani *et al*. (2006).

Local marketable bulbs yield (ton/fed.)

The results concerning the effect of humic, organic and NPK chemical fertilization on local marketable bulbs yield (ton/fed.) during 2011-2012 and 2012-2013 seasons are presented in Table (3) clearly reveal that there were significant differences among all studied treatments in this trait in both seasons. The highest values for this trait were recorded from NPK treatment in both seasons but there was no significant differences between both NPK and (org + 3/4 NPK) treatments in first season only. In contrasted of this, the untreated plants were gave the lowest local marketable bulbs yield in both studied seasons. Beside the role of organic manures which are valuable as a source of many fertilizers and essential macro and micronutrients to plants and serves as a good natural soil texture conditioner being rich in organic matter and increase availability and uptake of nitrogen, phosphorus and potassium which positively reflected on plant cell elongation and division as well as stimulate photosynthesis and metabolic processes of organic compounds in plant, thus increasing total bulbs yield. These results are in agreement trend with those found by El-Shaikh (2005), El-Desuki et al., (2006) and El-Shaikh (2005).

Exportable bulbs yield (ton/fed.)

Data presented in Table (4) illustrate that there were significant differences among the all fertilizer treatments in this trait. Also, the results showed that the inoculation among humic, organic and NPK fertilizer lead to obtain the best exportable bulbs yield in most fertilizer treatments. The highest values for this trait were recorded from treatment (Bio + org + 3/4 NPK) in both seasons. In other hand, untreated onion plants gave the lowest exportable bulbs yields. Applying of organic fertilizers was reported to increase the uptake of N, P, K, Ca, and Mg contents in the soil and, therefore, organic manure are considered to be a good source for soil fertility and that reverse of bulb quality (Nyathi and Campbll, 1995; Adenyian and Ojeniyi, 2003). The same results was found by Bagali et al. (2012) how presents that the combination of higher levels of inorganics with higher levels of organics recorded higher bulb yield. Bardisi et al., (2004) showed that use of bio-fertilizer with chemical fertilizer lead to improve in onion bulbs quality. Gamal and Hemida (2004) found that the highest yield and bulb quality were obtained from treatment, which received 120kg N + 3.0 kg Biogen per fed. Also, EL-Desuki et al., (2006) showed that the vegetative growth of onion plant, as well as bulbs yield and bulb quality was increased with increasing the level of mineral fertilizers application.

Table(4): Effect of Humic acid , biofertilizers and NPK chemical fertilizer of onion plant cultivar Giza 20 on Weight of Double bulbs (ton/fed) , Number of bolting bulbs /fed and Weight of Culls (ton/fed.)) in 2011-2012 and 2012-2013 seasons under Sohag conditions.

Characteristics Treatments	Weight of Double bulbs (ton/fed)		Number of bolting bulbs /fed		Weight of Culls (ton/fed.)	
	2011/2012	2012/2013	2011/2012	2012/2013	2011/2012	2012/2013
Untreated	0.416 BCDE	0.532 C	1200 G	1200. F	0.344 BCD	0.213 DEF
NPK(Recommended dose)	0.8827 A	0.920 A	2800 A	2800. A	0.6567 A	0.6400 A
Rhizobactrein+phosphorin +potasiumag (Bio)	0.8773 A	0.540 BC	1733 EF	1600. DEF	0.380 B	0.1300 GH
Humic acid (org)	0.7600 AB	0.733ABC	1600 FG	1400. EF	0.237 BCDEF	0.160 FGH
(Bio) + (org)	0.800 A	0.806 ABC	2000 DEF	1200. F	0.3653 BCD	0.204 DEFG
(Bio + 3/4 NPK)	0.606 ABCD	1.040 A	2667 AB	1200. F	0.2267 CDEF	0.189 EFGH
(Bio + 1/2 NPK)	0.762 AB	0.786ABC	2267 BCD	1400. EF	0.2173 DEF	0.4107 B
(Bio + 1/4 NPK)	0.4027 BCDE	0.746 ABC	2533 ABC	1200. F	0.3013 BCDE	0.2760 CD
(org + 3/4 NPK)	0.2893 DE	0.880 A	2267 BCD	1600. DEF	0.122 F	0.3413 BC
(org + 1/2 NPK)	0.369 CDE	0.933 A	2533 ABC	1867. CD	0.168 EF	0.3933 B
(org + 1/4 NPK)	0.360 CDE	0.853 AB	2667 AB	2133. BC	0.3680 BC	0.3600 B
(Bio + org + 3/4 NPK)	0.601 ABCD	0.800 ABC	2800 A	2400. B	0.2253 CDEF	0.1100 H
(Bio + org +1/2 NPK)	0.618 ABCD	0.856AB	2133 CDE	1600. DEF	0.1840 EF	0.1140 H
(Bio + org +1/4 NPK)	0.676 ABC	0.9027 A	1600 FG	1800. CDE	0.246 CDEF	0.2480 DE

Values followed by the same letter or letters are not significantly different at 5% level.

Weight of double bulbs (ton/fed.)

Data presented in Table (4) the highest values of this trait were recorded when onion plants received NPK treatment in both seasons. Also, there were no significant differences among most treatments except untreated in this trait in both seasons.

Weight of bolting bulbs (ton/fed.)

Data presented in Table (4) there were slightly significant differences among all fertilizer treatments in this trait in both seasons. The highest values were recorded when onion plants apply the recommended dose of NPK in both seasons. While, the lowest values were recorded from untreated onion plants in seasons 2011-2012 and 2012-2013 respectively. These results are in harmony with those found by Farag and Koriem (1990) and Mohamed and Hemida (2004) they reported that percentage of doubles tended to decrease with reducing N levels.

Number of bolting bulbs /fed

The results for the effect of humic, organic and NPK chemical fertilization and their interactions on weight of bolting bulbs (ton/fed.) during the two studied seasons are presented in Table (4). The results obviously show that the recommended dose of NPK treatment gave the highest values for this trait and were significantly higher than most other treatments in both seasons. Also, the results showed that inoculating onion transplants with both humic and organic fertilizer lead to decrease the number of bolting bulbs especially in the second season. These results are corresponding with those found by Jitendra et al., (1989) , Diaz-perez et al., (2003) .

Weight of Culls (ton/fed.)

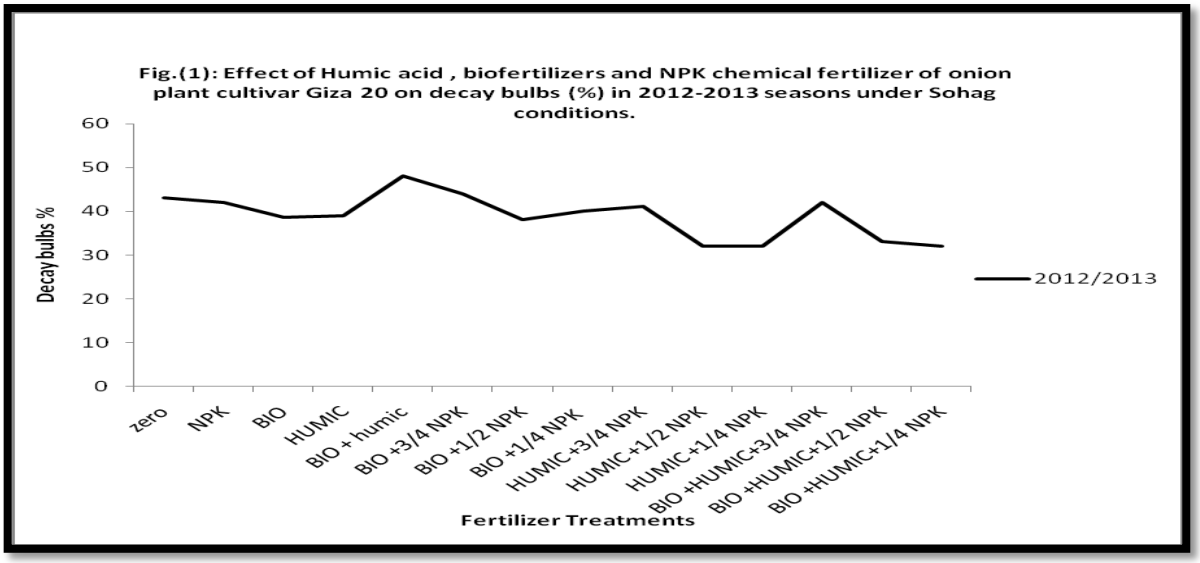
The results concerning the effect of humic, organic and NPK chemical fertilization on weight of Culls (ton/fed.) during 2011-2012 and 2012-2013 seasons are presented in Table (3) clearly reveal that there were significant differences among all studied treatments in this trait in both seasons. The results showed that apply the onion plants with the recommended dose of NPK was significantly higher than other treatments in both seasons. Also, reduce the NPK chemical fertilizer and apply both humic and organic fertilizer lead to improve for this trait in both seasons. These results are in agreement with those Farag and Koriem (1990) and Ahmed et al., (2013) they found decrease amount of NPK fertilizer and apply the bio and organic fertilizer lead to decrease bulbs culls.

Decay bulbs %

The results concerning the effect of humic, organic and NPK chemical fertilization on decay- bulbs (%) during the storage periods in Fig. (1) showed that the highest decay bulbs were recorded from treatment BIO + humic (48%) followed by treatment BIO +3/4 NPK(44%). On the other hand, the lowest decay bulbs was recorded when onion bulbs treated with treatments HUMIC +1/2 NPK , HUMIC +1/4 NPK and BIO +HUMIC+1/4 NPK and gave the same value of decay bulbs (32%).

Weight loss %

The results regarding the effect of humic, organic and NPK chemical fertilization on weight loss (%) every30 day intervals during the storage periods in Fig. (2) presented that the highest value of this trait was recorded from treatment BIO + humic in most months . While, the lowest values of bulb weight loss were recorded from treatment BIO +HUMIC+1/2 NPK.



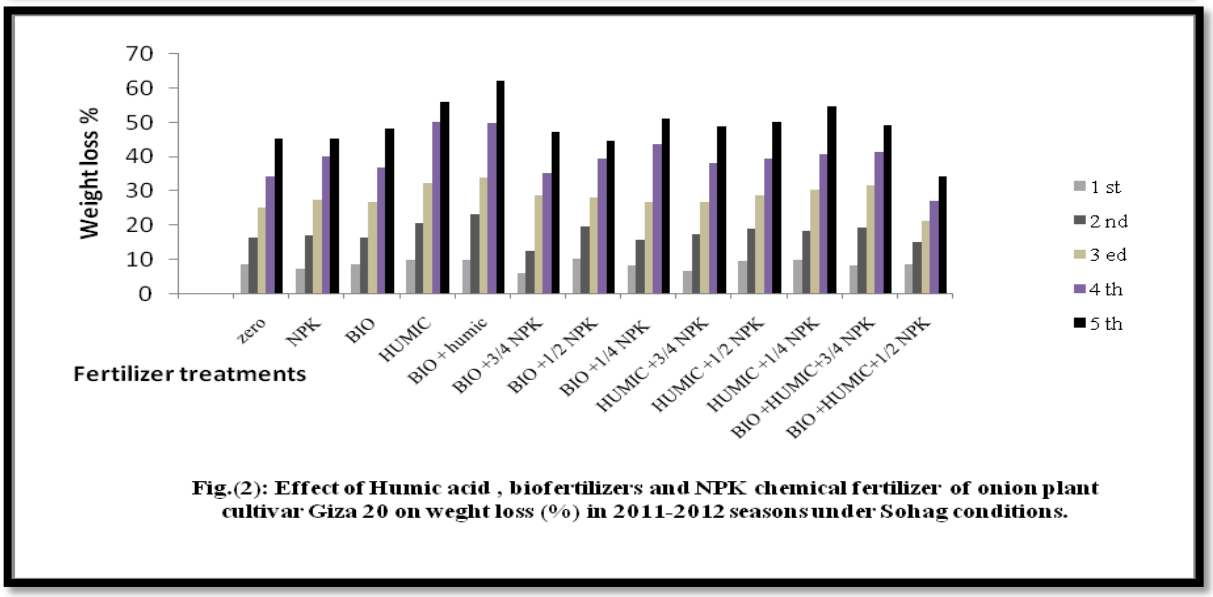


Fig.(2): Effect of Humic acid , biofertilizers and NPK chemical fertilizer of onion plant cultivar Giza 20 on weght loss (%) in 2011-2012 seasons under Sohag conditions.

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